

WHAT IS CLAIMED IS:

1. A granulated product comprising: carbonaceous particles and at least one carbonized synthetic resin, carbonized pitch component, or mixtures thereof, wherein said granulated product has attached at least one organic group.
- 5 2. The granulated product of claim 1, wherein said carbonaceous particles have a specific surface area of from about 15 to about 550 m²/g and a total micropore volume of from about 0.01 to about 2.0 ml/g.
3. The granulated product of claim 1, wherein said packing material has a ratio $V_{0.5}/V_{1.0}$ of about 0.4 or smaller, wherein $V_{0.5}$ is the nitrogen gas adsorption volume at a
10 relative pressure P/P_0 of 0.5 and $V_{1.0}$ is the nitrogen gas adsorption volume at a relative pressure P/P_0 of about 1.0 at a nitrogen gas adsorption isotherm.
4. The granulated product of claim 1, wherein said carbonaceous particles are carbon black particles.
5. The granulated product of claim 1, wherein said granulated product comprises
15 a carbonized synthetic resin and said synthetic resin is a phenol resin, a furan resin, a furfural resin, a divinyl benzene resin, a urea resin, or a combination thereof.
6. The granulated product of claim 1, wherein said granulated product comprises a carbonized pitch component and said pitch component is at least one of a toluene-soluble pitch component or a benzene-soluble pitch component, or a combination thereof.
- 20 7. The granulated product of claim 6, wherein said pitch component comprises a petroleum pitch, a coal-tar pitch, a liquefied coal oil, or a combination thereof.
8. The granulated product of claim 1, wherein said carbonaceous particles comprise 100 parts by weight carbon black and said mixture comprises from about 5 to about 500 parts by weight said synthetic resin, pitch component, or both.
- 25 9. The granulated product of claim 1, wherein said organic group contains an ionic group or an ionizable group.
10. The granulated product of claim 1, wherein said carbonaceous particles are substantially spherical.
11. The granulated product of claim 1, wherein said carbonaceous particles are
30 aggregates comprising a carbon phase and a silicon-containing species phase.

12. The granulated product of claim 1, wherein said carbonized synthetic resin, carbonized pitch component, or carbonized synthetic resin/pitch component mixture has been carbonized by heating to a temperature of from about 400° C to less than 800° C.

13. The granulated product of claim 1, wherein said carbonized synthetic resin, carbonized pitch component, or carbonized synthetic resin/pitch component mixture has been carbonized by heating to a temperature of from about 400° C to about 700° C.

14. A method of chromatographic separation or solid phase extraction comprising passing a sample having components to be separated through a plurality of the granulated products of claim 1.

15. A method of liquid chromatographic separation or solid phase extraction comprising passing a sample having components to be separated through a plurality of the granulated products of claim 1.

16. A method of making carbonaceous particles-containing granules comprising: mixing carbonaceous particles with: at least one synthetic resin, pitch component, or a mixture thereof; and a solvent, to form a mixture; granulating said mixture to form granules; carbonizing said granules; and attaching at least one organic group to said granules.

17. The method of claim 16, wherein said granules are carbonized by heating to a temperature of from about 400° C to less than 800° C.

18. The method of claim 16, wherein said granules are heated to a temperature sufficient to carbonize the synthetic resin, pitch component, or both.

19. The method of claim 16, wherein said temperature is sufficient to carbonize said synthetic resin, pitch component, or both, and to evaporate said solvent without graphitizing said granules.

20. The method of claim 16, wherein said solvent is a non-aqueous solvent.

21. The method of claim 16, wherein said solvent is aqueous solvent.

22. The method of claim 16, wherein said mixture comprises a pitch component and said pitch component is a toluene-soluble pitch component, a benzene-soluble pitch component, or a combination thereof.

23. The method of claim 16, wherein the process used to granulate said mixture is spray drying.

24. The method of claim 20, wherein said pitch component comprises a petroleum pitch, a coal-tar pitch, a liquefied coal oil, or a combination thereof.

5 25. The method of claim 16, wherein said mixture comprises a synthetic resin and said synthetic resin comprises a phenol resin, a furan resin, a furfural resin, a divinyl benzene resin, a urea resin, or a combination thereof.

26. The method of claim 16, wherein said carbonaceous particles comprise 100 parts by weight carbon black and said mixture further comprises from about 10 to about 500 parts by weight said synthetic resin, pitch component, or both.

10 27. The method of claim 16, wherein said carbonaceous particles comprise carbon black particles having a ratio L_{\min}/L_{\max} of a minor axis diameter L_{\min} to a major axis diameter L_{\max} of from about 0.95 to about 1.0, a particle diameter of from about 2 to about 200 μm , a specific surface area of from about 10 to about 650 m^2/g , a total micropore volume of from about 0.3 to about 2.0 ml/g , and a $V_{0.5}/V_{1.0}$ ratio of about 0.4 or smaller wherein $V_{0.5}$ is the gas adsorption volume at a relative pressure P/P_0 of 0.5 and $V_{1.0}$ is the nitrogen gas adsorption volume at a relative pressure P/P_0 of about 1.0 at nitrogen gas adsorption isotherm.

28. The method of claim 16, wherein said carbonaceous particles are substantially spherical.

20 29. The method of claim 16, wherein said carbonaceous particles are aggregates comprising a carbon phase and a silicon-containing species phase.

30. The method of claim 16, wherein said granulating comprises a spray granulation or an emulsion granulation method.

25 31. The method of claim 16, wherein said carbonaceous particles comprise carbon black having an average particle diameter of from about 12 to about 40 nm and said mixing comprises mixing 100 parts by weight said carbon black with about 10 to about 250 parts by weight of said synthetic resin, pitch component, or both.

30 32. The method of claim 16, wherein said carbonaceous particle comprises carbon black having an average particle diameter of from about 12 to about 30 nm, a specific surface area of from about 80 to about 250 m^2/g , and a DBP oil adsorption of from about 80 to about 200 $\text{ml}/100\text{g}$.

33. The method of claim 16, wherein said granulating comprises granulating said mixture by spray granulation or emulsion granulation to obtain granules whose ratio L_{\min}/L_{\max} of a minor axis diameter L_{\min} to a major axis diameter L_{\max} is from about 0.90 to about 1.0.

34. The method of claim 16, wherein said attaching comprises reacting said granules with a diazonium salt.

35. The method of claim 16, wherein said organic group comprises an ionic group or an ionizable group.

36. The granulated product of claim 1, wherein said granulated product has a ratio L_{\min}/L_{\max} of a minor axis diameter L_{\min} to a major axis diameter L_{\max} of from about 0.75 to about 1.25, a particle diameter of from about 2 to about 200 microns, a specific surface area of from about 10 to about 650 m^2/g , and a total micropore volume of from about 0.08 to about 2.0 ml/g .

37. A method of making carbonaceous particles-containing granules comprising: mixing carbonaceous particles having attached at least one organic group with: at least one synthetic resin, pitch component, or a mixture thereof; and at least one solvent, to form a mixture;

granulating said mixture to form granules; and
carbonizing said granules.

38. The method of claim 37, further comprising attaching a second organic group to said granules after carbonizing, wherein said second organic group is the same or different from said organic group.

39. A granulated carbonaceous product comprising carbonaceous particles and at least one carbonized binder, produced by the process of:

mixing the carbonaceous particles with at least one carbonizable binder and an aqueous solvent;

granulating said mixture to form granules; and
carbonizing said granules, at a temperature of from about 400° C to less than 800° C.

40. The product of claim 39, wherein the carbon particles are carbon black and the carbonizable binder is a water-compatible phenolic resin, and wherein the mixture comprises 100 parts by weight of carbon black and from about 5 to about 100 parts by weight of said carbonizable binder.

41. A granulated carbonaceous product comprising carbonaceous particles and at least one carbonized binder, produced by the process of:

mixing the carbonaceous particles with at least one carbonizable binder and an aqueous solvent;

5 granulating said mixture to form granules; and
carbonizing said granules, wherein the mixture comprises 100 parts by weight of carbon black and from about 5 to less than 50 parts by weight of at least one carbonizable binder.

42. The granulated carbonaceous product of claim 39, wherein said granules have
10 attached a carbonizable binder.

43. The granulated carbonaceous product of claim 39, wherein said product has a particle size of from about 2 to about 5 microns.

44. A granulated carbonaceous product comprising carbonaceous particles and at least one uncarbonized binder, produced by the process of:

15 mixing the carbonaceous particles with at least one binder and at least one solvent;
granulating said mixture to form granules; and
heating said granules at a temperature below the carbonaceous temperature of the binder to form said granulated carbonaceous product.

45. The granulated carbonaceous product of claim 44, wherein said carbonaceous
20 particles have attached at least one organic group.

46. A granulated carbonaceous product comprising carbonaceous particles and at least one carbonized binder, produced by the process of:

mixing the carbonaceous particles with at least one carbonizable binder and an aqueous solvent;

25 granulating said mixture to form granules; and
carbonizing said granules, wherein said at least one carbonizable binder is attached onto said carbonaceous particles.